Improving the EU Input-Output Database for Global Trade Analysis: the EU-GTAP Project

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Abstract:

The European Commission's DG TRADE and DG Joint Research Centre (DG JRC) are presently working together in the so called EU-GTAP Project. The objective of the EU-GTAP project is to ensure that the Commission bases its trade modelling analysis on the most reliable and recent Supply, Use and Input-Output tables as inputs to its modelling tools, mainly the GTAP database. Bearing this in mind, the main outcome of this project is the submission (to GTAP) of a set of Input-Output Tables for the 28 Member States for the year 2010 under the new European System of Accounts (ESA2010) methodology and in compliance with GTAP submission requirements.

Keywords: European Union, Supply-Use tables, Input-Output Tables, GTAP, VAT, Taxes, Subsidies.

1. Background

The European Court of Auditors recently scrutinised the way the European Commission analyses the impact of free trade agreements with its external partners[1]. The main objective of the Court's audit was to evaluate whether the Commission has appropriately assessed the economic effects of its preferential trade agreements. Subsequently the Court issued recommendation in specific area for the Commission to improve its assessment. In this context one of the recommendations of the Court was in respect to the need for updating the database used as an input for the modelling analysis carried out by the Commission.

More specifically the Court found that the Input-Output tables in the GTAP database rely on supply and use tables at current prices for the year 2000 although more recent data is available at Eurostat (ESTAT). Hence the Court recommends updating the supply and use tables for EU28 Member States so as to reflect the most accurate technical coefficients and structures of commodities for final and intermediate use.

With this purpose, the European Commission's DG TRADE and DG Joint Research Centre (DG JRC) are presently working together in the so called EU-GTAP Project. The objective of the EU-GTAP project is to ensure that the Commission bases its trade modelling analysis on the most reliable and recent Supply, Use and Input-Output tables as inputs to its modelling tools, mainly the GTAP database. Bearing this in mind, the main outcome of this project is the submission (to GTAP) of a set of Input-Output Tables for the 28 Member States for the year 2010 under the new European System of Accounts (ESA2010) methodology and in compliance with GTAP submission requirements.

DG JRC will use ESA2010 ESTAT Supply, Use and IO Tables (with NACE Rev.2 / CPA 2008 resolution) for 2010 and for each Member State (EU28) to make the conversion from NACE/CPA classification into the GTAP classification. The delivery to GTAP is scheduled for the end of 2015. The DG JRC will proceed to estimate missing countries wherever necessary following a set of good practice guidelines developed by ESTAT and the DG JRC (Rueda-Cantuche et al, 2015) and it will also project missing tables using the Euro method (Eurostat, 2008). Those guidelines have already been endorsed by some of the Member States of the EU through the regular meetings of the Eurostat Technical Group on the Consolidation of European Supply, Use and Input-Output Tables. The Input-Output (IO) tables to be delivered to GTAP will include a matrix of imports distinguishing between intermediate uses by activity and final demand by user. They will also distinguish between extra-EU and intra-EU exports by product. However, this distinction is not available in imports, although it could be estimated using the COMEXT database.

As supplementary tasks, the DG JRC will investigate the sources of difference in Supply and Use tables for 2010 between the two different European accounting systems (ESA95 and ESA10). Besides, the project will also provide fully-fledged matrices of Taxes less Subsidies on Products that may be split into: VAT; Other taxes on products (excises), excluding import tariffs; Import tariffs, depending on data availability; Subsidies on agricultural products; and Other subsidies on products.

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[1] European Court of Auditors (2014), Are preferential trade arrangements appropriately managed? Special report.

2. Process of estimation

2.1. GTAP requirements

The main objective of the EU-GTAP Project is twofold: the Input-Output Tables produced must be in line with GTAP requirements and must include the most recent updated Supply, Use and Input-Output Tables (and methods) from Eurostat, as suggested by the European Court of Auditors.

The next section describes how this project makes sure that the most recent updated Eurostat data and methods are incorporated in the results of the project. As regard the compliance with GTAP requirements, Huff et al (2000) describes the requirements of the Input-Output databases contributions. They refer to the following aspects:

a) The construction of Input-Output tables (Huff et al, 2000, section 2)
b) The product breakdown should match GTAP sectorial classification and the IO table should have GTAP's format (Huff et al, 2000, sections 3 and 4)
c) Treatment of imports (Huff et al, 2000, section 5)
d) Checking accounting identities and non-negativity (Huff et al, 2000, section 6)
e) Reporting data sources and problems encountered should be included into a documentation (Huff et al, 2000, section 8)

In line with these requirements, the final dataset will consist of a set of IOTs for the 28 Member States for 2010 in the new ESA2010 and the GTAP classification, to be delivered by December 2015. In particular, this submission corresponds to the so called UF tables (strictly IO tables with a distinction between domestic and import uses) as in Huff et al (2000). Complementarily, the submission of the so called UP tables (IO tables plus Taxes less subsidies on products) will be done by spring 2016. A final report will eventually be written describing the methodology, data sources and problems encountered, of which its final version will be submitted in June 2016.
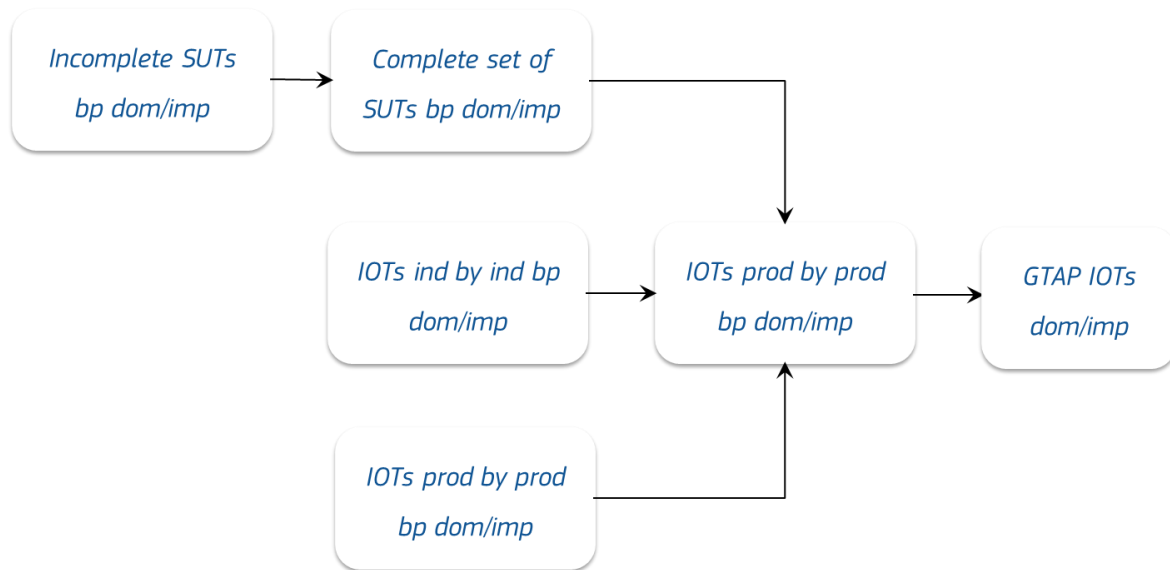
2.2. Process of estimation: the UF tables

The process of construction of the UF tables will be different depending on the available information (Figure 1). Wherever official product by product IOTs are available with a proper distinction between domestic and import uses, they will be directly transformed into the GTAP classification. However, some countries produce industry by industry IOTs instead. In such case, we will use the mathematical formulations described in Rueda Cantuche (2011) to derive the corresponding product by product IOTs on the basis of the available industry by industry official IOTs. Subsequently, they will be transformed into the GTAP classification.

But the most demanding task is to produce IOTs out from official Supply and Use Tables (SUTs) at basic prices. Although there will be official SUTs available for some countries, it will not be the case for others. In such cases, we will adopt the good practice guidelines developed by the DG Joint Research Centre for Eurostat (Rueda-Cantuche et al, 2015) and the so called Euro method (Eurostat, 2008) for the estimation and projection of SUTs, respectively. Compared with other projection methods like those using cross-entropy functions or the minimum information loss

principle, the Euro method has the advantage of assuming the Leontief input-output model to make the projections, rather than minimising the distance between the resulting table and the base one.

Once SUTs have been projected or estimated, product by product IOTs will be constructed using the industry technology assumption (Model B, in Eurostat, 2008). Those IOTs will eventually be transformed into UF tables by complying with the GTAP classification.

Figure 1. Construction of the UF tables

If the distinction between domestic and import uses were absent, we would use the Eurostat's good practice guidelines (Rueda-Cantuche et al, 2015) to estimate them before applying the process described in Fig.1.

2.3. Process of estimation: the UP tables

Following Huff et al (2000), the UP tables are the sum of the UF tables and (product by product) tables of Taxes less Subsidies on Products (TLS) with a distinction between net taxes revenues coming from domestic and imported uses. However, the Eurostat submissions are (product by industry) tables of Taxes less Subsidies on Products (TLS) without such a distinction between domestic and import driven net taxes revenues. Therefore, this project will implement a mechanism (see Figure 2) to convert the Eurostat TLS tables into the TLS tables as required by the GTAP database. Once these tables will be estimated, the UP tables will be produced straightforwardly by adding the UF tables to them.

Figure 2. Construction of the UP tables (TLS)
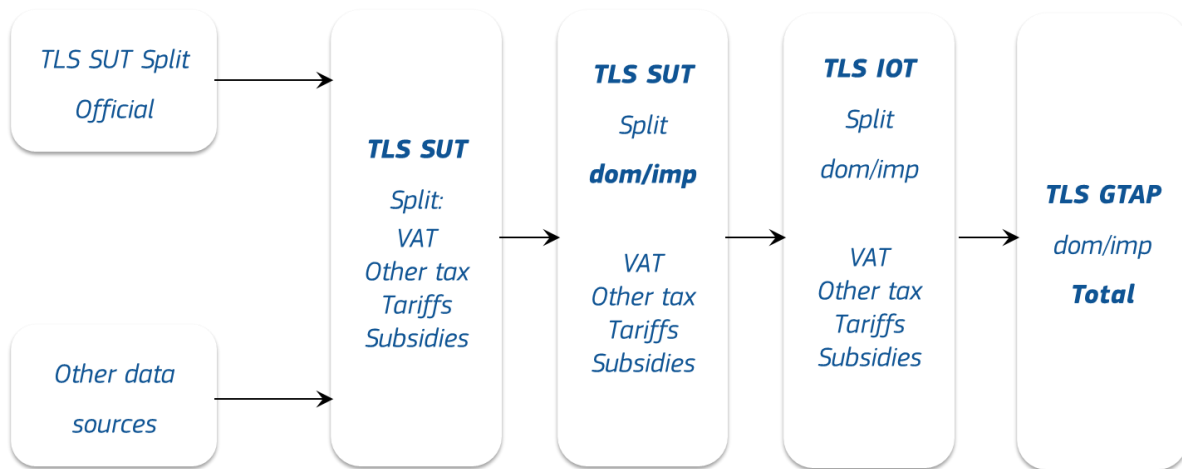
The process will estimate the TLS tables as the sum of four separate tables concerning: VAT, other taxes on products (excises), import tariffs and subsidies on products (in negative values). Wherever official tables will be available, we will use them directly. Otherwise, we will use other data sources relevant for the split and estimation of the various tables (see section 3 for further details) together with the available official (product by industry) total TLS tables. Next, the full set of tables will be split up into tax revenues coming from domestic and from import uses (the same applies to subsidies). We will take into account that import tariffs should only be linked to the import use tables for carrying out the split. In a third step, we will develop an ad-hoc transformation method to estimate the (product by product) TLS tables taking into account all other information that could be available in product by product IOTs and official total (product by industry) TLS tables. As a final step, the resulting tables of VAT, other taxes on products, tariffs and subsidies on products will be aggregated to form one single TLS table (total) that will be converted into the GTAP classification.

3. Data sources

3.1. Eurostat: Supply, Use and Input-Output Tables; and valuation matrices

The Regulation (EU) No 549/2013 of the European Parliament and of the Council of 21 May 2013 on the European System of National and Regional Accounts in the European Union implements the European System of National Accounts (ESA 2010). This regulation determines the methodology to be used for the compilation of national accounts data to be submitted to Eurostat, as well as the data transmission programme. The transmission of data related to the SUIOTs from the Member States and EFTA countries is defined in this regulation (annual for Supply and Use Tables and five-yearly for Input-Output Tables).

The European System of National and Regional Accounts (ESA 2010) is the newest internationally compatible EU accounting framework for a systematic and detailed description of an economy. ESA 2010 was published in the Official Journal on 26 June 2013. It will be implemented as from

September 2014; from that date onwards the data transmission from Member States to Eurostat will follow ESA 2010 rules. The ESA2010 Transmission programme (TP) of data describes the programme of national accounts data delivery within the framework of the new ESA 2010, as defined in Annex B of the Council Regulation (EU) No 549/2013 of the European Parliament and of the Council of 21 May 2013 (cf. also Article 3 of this regulation).

The ESA2010 TP establishes that Member States must deliver on an annual basis Supply Tables at basic prices, including a transformation into purchasers' prices and Use Tables at purchasers' prices; and on a five-yearly basis (for reference years ending in 0 or 5) Input-Output Tables at basic prices. With the new ESA2010 TP, the following five additional tables at current prices must also be delivered starting from the reference year 2010 onwards:

— Use table at basic prices;
— Use table for domestic output at basic prices;
— Use table for imports at basic prices;
— Table of trade and transport margins;
— Table of taxes less subsidies on products

This project will therefore rely on the expected submissions of the Member States and will estimate the missing tables using as much as possible official statistics and the Eurostat and the DG JRC expertise coming from their current experience in the construction of the EU and euro area consolidated SUIOTs (Rueda-Cantuche et al, 2015 and Eurostat, 2008).

As of April 2015, thirteen countries are available and four other countries are expected to deliver the tables before June 2015; with respect to the remaining eleven countries, we will most likely have to project 6 countries using projection methods (i.e. Euro method from Eurostat, 2008) and estimate 5 countries, using the set of good practice guidelines developed by the DG JRC for Eurostat (Rueda-Cantuche et al, 2015). The conversion of Supply and Use tables into (product by product) Input-Output Tables will be done using the industry technology assumption (Model B, in Eurostat, 2008).

3.2. Other data sources

Besides the collection of Supply, Use and Input-Output Tables and valuation matrices, the following datasets will be useful for: (a) splitting up the matrices of Taxes less Subsidies on Products (TLS) into VAT, other taxes on products, import tariffs and other subsidies on products, separately; and (b) transforming the resulting tables from the CPA-NACE format into the GTAP classification.

3.2.1. National Tax Lists (NTL)

The National Tax Lists contain detailed lists of taxes, social contributions and related tax revenues according to national and System of National Accounts (SNA) classifications, often for the period 1995-2012.

However, the lists are still far from being homogenous across countries in terms of the degree of detail and reporting periods, thus leading to time consuming manual adjustments. Our preliminary

investigation of the Czech, Portuguese and Slovak data also revealed that there are occasionally apparent differences and inconsistencies between the NTL and other sources (notably the TLS matrix or the National Accounts values). As a result, this project will elaborate a reconciliation process that will be described in detail in the final report of the project (June 2016).

3.2.2. National Accounts (NAs)

Eurostat provides data on National Accounts for all SNA categories (e.g. taxes, although with less detail) and institutional sectors (in national currency). Eurostat also provides the main national accounts tax aggregates by country, broken down into rather detailed tax categories. It is also worth mentioning that it also includes the tax received by the EU institutions, e.g. a part of the VAT and the bulk of the import duties.

The values from NAs may often differ due to different vintages of data revisions /submissions. For our purposes, supplementary data from NAs/NTL/... will be re-scaled to SUIOTs totals in order to preserve a balanced Input-Output framework.

3.2.3. DG TAXUD: Excise taxes

The excise tax revenues by excise goods can be found in the following publications downloadable from the DG TAXUD homepage:

European Commission: Excise Duty Tables – Tax receipts (Energy products and Electricity, Alcoholic beverages, Tobacco) – publication of the EC Directorate General Taxation and Customs Union (TAXUD) in July 2012 Ref 1.035.

In the case of the energy products, additional information on rates and other auxiliary information (subsidies, VAT-rates) can be found in the following publication:

European Commission: Excise Duty Tables – Part II – Energy products and Electricity – publication of the EC Directorate General Taxation and Customs Union (TAXUD) in January 2010), Ref 1.030.

3.2.4. Value Added Tax

The data on Value Added taxes can be found in the following publications:

CASE (Centre for Social and Economic Research): '2012 Update Report to the Study to quantify and analyse the VAT Gap in the EU-27 Member States' – report commissioned by the European Commission (DG TAXUD) and published in Warsaw, September 2014 (TAXUD/2013/DE/321, FWC No. TAXUD/2010/CC/104 EC VAT-gap).

European Commission [2004]: TAXATION PAPERS – 'VAT indicators' – working paper (No. 2/2004, DOC TAXUD/2004/2004–EN) – publication of the EC Directorate General Taxation and Customs Union.

European Commission [2012]: 'VAT Rates Applied in the Member States of the European Community – Situation at 1st July 2010' – Taxud.c.1(2010) 477911 – EN publication of the EC Taxation and Customs Union.

Reckon [2009]: Study to quantify and analyse the VAT gap in the EU-25 Member States, study report written for the DG Taxation and Customs Union (TAXUD).

Schneider [2010]: The Shadow Economy in Europe, 2010, Johannes Kepler University of Linz, publication of the A.T. Kearney consulting firm.

3.2.5. Agriculture and food industry specific data

The following information will be used to deal with agricultural and food industry data related to taxes and subsidies on products.

Britz and Witzke (2012), "CAPRI model documentation: 2014", database of the "Common Agricultural Policy Regional Impact" modelling system (CAPRI) at Member State level http://www.capri-model.org/docs/capri_documentation.pdf

OECD Producer and Consumer Support Estimates database (2014) and the OECD specific document: European Union: Estimates of Support to Agriculture; this database will be useful for the estimation of subsidies on products. http://www.oecd.org/tad/agricultural-policies/producerandconsumersupportestimatesdatabase.htm

Eurostat database on Economic Accounts for Agriculture and other related Eurostat databases.

Eurostat's Structural Business Statistics by industry and enterprises (NACE Rev. 2, B-E) will be used for the transformation of the food industry sectors.

3.2.6. Other data sources

Although not exhaustive, these are additional data sources that will be used in the project for various purposes:

Investment by institutional sectors (Eurostat)

Environmentally Related Taxes, Fees and Charges – Revenues raised by environmentally related taxes for selected countries – OECD database (http://www2.oecd.org/ecoinst/queries/Query_2.aspx?QryCtx=2). This information is essential to allocate product taxes correctly on the products where they were levied. Some of these environmental tax revenues may belong to the "other taxes on production", which is part of the gross value added and not part of the "taxes on products", as stated in the SNA08.

Eurostat's National Accounts Main Aggregates; consumption expenditure by COICOP categories (Eurostat website); this will be used in computing the average VAT rates for some CPA products and for estimating the household related excise taxes.

Exchange rates against the Euro and USD will also be used from the Eurostat website.

Other country specific data sources such as for Hungary and the Czech Republic: longer lists of tax revenues by products; more detailed Supply and Use tables, and investment matrices by asset and institutional sectors.

4. References

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Rueda-Cantuche, J.M., Beutel, J., Remond-Tiedrez, I. and Amores, A. F. (2015) "Good Practice Guidelines in the Estimation of National Use Tables at Basic Prices and Valuation Matrices: An Illustration with European Countries", Economic Systems Research, *under revision*.